Oliver Fabio Piattella

Key publications

Updated 6 September 2026

A selection of seven publications, with comments on their results and significance in my research.

1. 2010

O. F. Piattella, *The extreme limit of the generalised Chaplygin gas*, JCAP **1003** (2010) 012, arXiv:0906.4430.

In this paper I study the large-α regime of the generalised Chaplygin gas, a unified description of dark matter and dark energy. The analysis shows that large values of α can reopen a region allowed by the observational tests considered in the paper, despite the severe restrictions usually associated with this model. I also discuss a possible connection with the cuscuton, a scalar-field model with no additional local propagating degree of freedom.

This was my first single-authored publication, developed during my PhD. It marks an important step towards independent research. Its significance lies in exploring an unconventional parameter regime; the historical viability result should not be read as a validation against present-day cosmological data.

2. 2012

C. E. M. Batista, M. H. Daouda, J. C. Fabris, O. F. Piattella and D. C. Rodrigues, *Rastall Cosmology and the* Λ*CDM Model*, Phys. Rev. **D85** (2012) 084008, arXiv:1112.4141.

We study a cosmological model within Rastall's framework, where the usual local conservation law for the energy-momentum tensor is modified. The model reproduces the background and linear matter-perturbation evolution of ΛCDM while allowing the dark-energy component to cluster. Spherical collapse provides a setting in which departures from the standard model can emerge.

The paper connects modified gravitational dynamics with clustering dark energy and the formation of cosmic structures. My contribution concerned the perturbative analysis in Newtonian gauge and the study of spherical collapse. The modified conservation law is treated phenomenologically, without claiming a derivation from a complete quantum theory of gravity.

3. 2016

O. F. Piattella, *Lensing in the McVittie metric*, Phys. Rev. D **93** (2016) no.2, 024020, arXiv:1508.04763.

I investigate light deflection using the McVittie metric, which describes a central mass in an expanding cosmological background. This framework makes it possible to treat the cosmological setting of the lens, source and observer explicitly. For the constant-H case analysed in detail, the leading deflection term receives no additional explicit contribution from the cosmological constant.

The paper is important for my research because it addresses gravitational lensing within an exact cosmological geometry. The result concerns the leading deflection term in the adopted approximation: cosmology still enters observable lensing quantities through distances and the source–lens–observer geometry.

4. 2016

O. F. Piattella, *On the effect of the cosmological expansion on the gravitational lensing by a point mass*, Universe 2016, 2(4), 25, arXiv:1609.00270.

This work extends the McVittie analysis to a time-dependent Hubble parameter. The leading deflection term retains its usual form, while corrections at higher order depend on the cosmological expansion.

The paper develops the connection between local light deflection and the cosmological background beyond the constant-H approximation. It motivates investigating whether such corrections could carry information about the expansion history. This is a theoretical possibility rather than an established method for extracting $H(z)$ from strong-lensing observations; its practical value depends on the size of the corrections and the control of lens modelling.

5. 2017

O. F. Piattella and L. Giani, *Redshift drift of gravitational lensing*, Phys. Rev. D **95** (2017) no.10, 101301, arXiv:1703.05142.

With Leonardo Giani, then my PhD student co-supervised by Luca Amendola, I investigate the secular evolution of strongly lensed image positions and time delays caused by cosmological expansion. These effects are related to redshift drift and could, in principle, provide information about $H(z)$. Measuring time-delay drift would rely on repeated timing rather than a direct spectroscopic measurement of redshift drift.

The paper proposes an additional route for studying cosmic expansion with gravitational lensing. The predicted signals are extremely small, and detecting them would require separating the cosmological contribution from lens evolution and other time-dependent effects. The proposal should therefore be understood as a long-term observational prospect.

6. 2025

L. Giani, R. Von Marttens and O. F. Piattella, *The matter with(in) CPL*, The Open Journal of Astrophysics **8** (2025), doi:10.33232/001c.142699, arXiv:2505.08467.

We examine a phenomenological alternative to dynamical dark energy in which matter acquires a nonzero effective equation of state at low redshift. For the data combination studied, its statistical performance is comparable to that of the CPL dark-energy parametrization.

This recent work highlights a degeneracy in interpreting cosmological observations: apparent evidence for evolving dark energy may also motivate examining the effective properties of matter.

7. 2026

G. Bianchi, F. Re and O. F. Piattella, *Dark Coriolis Fields*, Eur. Phys. J. Plus **141** (2026), 275, doi:10.1140/epjp/s13360-026-07489-9, arXiv:2510.21470.

We explore Coriolis fields in the Newton–Cartan description of gravity and their possible role in galactic dynamics. The solutions studied can support approximately flat rotation profiles.

This work represents a recent direction in my research on the Newtonian limit and phenomena usually attributed to dark matter. It investigates a theoretical mechanism; establishing its observational viability requires further work.